Curriculum Vitae for
CARL I. STEEFEL

Geochemistry Department, Earth Sciences Division
Lawrence Berkeley National Laboratory
1 Cyclotron Road, Mail Stop 90R1116
Berkeley, CA 94720
Phone: 510-486-7311
Fax: 510-486-5686
E-Mail: CISteefel@lbl.gov

EDUCATION:

	Princeton University
1974	Washington University - B.A. English Literature
1982	University of Colorado, Boulder - M.S. Geology.
1987	Yale University - M.Phil. Geology
1992	Yale University - Ph.D Geochemistry, May 1992.

EXPERIENCE:

2004-present	Staff Scientist, Earth Sciences Division, Lawrence Berkeley National Laboratory
1998- 2004	Staff Scientist, Environmental Science Division, Lawrence Livermore National Laboratory
1995- 1998	Assistant Professor of Geology, University of South Florida
1995	Senior Research Scientist, Interfacial Geochemistry Group, Battelle Pacific Northwest Laboratories
1993-1995	Research Scientist, Interfacial Geochemistry Group, Battelle Pacific Northwest Laboratories
1991-1992	Post-doctoral Associate, Mineralogisch-Petrographisches Institut, Universitat Bern, Switzerland
1985-1991	Teaching and research fellowships, Yale University Department of Geology
1985	Project geologist, Anaconda Minerals,
1983-1985	Staff geologist, Anaconda Minerals
1981-1983	Geologist, Anaconda Minerals
1979-1980	Temporary geologist, Anaconda Minerals
1978	Geological assistant, U.S.G.S. Branch of Exploration Research
1976	Manuscripts librarian, Huntington Library, San Marino, California

RESEARCH INTERESTS:

Reactive contaminant transport: Contaminant migration in groundwater and the vadose zone
Chemical weathering: Developing quantitative reactive transport models for rock weathering
Reactive transport modeling: Approaches to numerical modeling of reactive contaminant transport and water-rock interaction
Mineral-water kinetics: Mineral dissolution and precipitation kinetics
Biogeochemistry: Biogeochemical reactions in groundwater and estuaries
Hydrothermal systems: Mineral-water reactions and transport in mid-ocean ridge and off-axis hydrothermal systems

AWARDS & RECOGNITION:

2005 Keynote speaker, Geochemical and Transport Modeling, 10th International Conference on Migration of Behaviour of Actinides and Fission Products in the Geosphere, *Migration 2005 Avignon, France, September, 2005.*

2005 Invited speaker, Conceptualizing Subsurface Biogeochemical Processes, *2005 International Symposium for Subsurface Microbiology, Jackson, Wyoming, August, 2005.*

2004 Invited speaker, Quantifying Rates in Biogeochemical Reaction Networks, *Goldschmidt Conference*, June 2004.

2004 Keynote speaker, Reactive transport modeling of multicomponent cation exchange at the laboratory and field scale, *Workshop on Conceptual Model Development for Subsurface Reactive Transport Modeling of Inorganic Contaminants, Radionuclides, and Nutrients*, April 20-22, 2004, Albuquerque, New Mexico.

2003 Keynote speaker, *International Conference on Gas-Water-Rock Interaction with Application to CO_2 Sequestration and Petroleum Migration*, Institut Francaise du Petrole, Rueuil-Malmaison, France, Nov. 20-22, 2003.

2001 Keynote speaker, Migration 2001 Meeting in Bregenz, Austria.

2000 Plenary session speaker, Computational Methods in Water Resources XIII, Calgary, Canada.

1998 Keynote Speaker, European Research Conference on *Geochemistry of Crustal Fluids: Characterization of reactive transport in natural systems*, Heraklion, Crete.

1995 Keynote Speaker, European Research Conference on *Natural Waters and Water Technology*, Lenggries, Germany

1994 Keynote Speaker, Chapman Conference on "Hydrogeologic Processes: Building and Testing Atomistic to Basin-Scale Models", June 6-9, 1994, Lincoln, New Hampshire

1990 Philip M. Orville Prize for outstanding research and scholarship, Dept. of Geology and Geophysics, Yale University

1990 Best Student Contribution, 2nd International Symposium on the Geochemistry of the Earth's Surface and of Mineral Formation, Aix-en-Provence, France (with P. Van Cappellen, K.L. Nagy, and A.C. Lasaga)

1989 Outstanding Mention, GSA Research Proposal

1974 Phi Beta Kappa, Washington University

INVITED PRESENTATIONS:

2004 Invited speaker, Quantifying Rates in Biogeochemical Reaction Networks, *2004 Goldschmidt Conference*, June 2004.

2004 Keynote speaker, Reactive transport modeling of multicomponent cation exchange at the laboratory and field scale, *Workshop on Conceptual Model Development for Subsurface Reactive Transport Modeling of Inorganic Contaminants, Radionuclides, and Nutrients*, April 20-22, 2004, Albuquerque, New Mexico.

2003 Keynote speaker, *International Conference on Gas-Water-Rock Interaction with Application to CO_2 Sequestration and Petroleum Migration*, Institut Francaise du Petrole, Rueuil-Malmaison, France, Nov. 20-22, 2003.

2001 Invited speaker, DOE NABIR Workshop on Biogeochemical Modeling, October 21-22, 2001 at Pennsylvania State University.

2001 Invited speaker, 2001 Goldschmidt Meeting, Session on *Metals in the Weathering Environment*

2000 Plenary session speaker, Computational Methods in Water Resources XIII, June 25-29, 2000, Calgary, Canada.

2001 Invited speaker, AGU special session *Coupled Biogeochemical Processes Affecting the Transport of Contaminants in the Subsurface*, spring 2000

1999 University of Waterloo, Waterloo, Canada, a seminar entitled *Comparing Laboratory and Field Reaction/Weathering Rates: Is There a Discrepancy?*, April 27, 1999.

1999 Woods Hole Oceanographic Institute, a seminar on *Reactive Transport in Discrete Fractures: The role of Chemical Kinetics and Permeability Change*, April 15, 1999.

1999 University of Oregon Department of Geology, a seminar on *Reactive Transport in Discrete Fractures: A Case Study from Maqarin, Jordan*, March 12, Eugene, Oregon.

1999 Oregon State University Department of Geology, a seminar on *Reactive Transport in Discrete Fractures: A Case Study from Maqarin, Jordan*, March 11, Corvallis, Oregon.

1998 *Geochemical Kinetics: From the Laboratory to the Field*, presented at the European Research Conference on *Geochemistry of Crustal Fluids: Characterization of Reactive Transport in Natural Systems*. May 22-27, Heraklion, Crete.

1997 *Overview of Modeling of Coupled Reactive Transport Processes* presented at the Alternative Models and Interpretations for the Near-Field Altered Zone Coupled Effects Expert Elicitation Workshop, Dec. 3-4, 1997, Las Vegas, Nevada.

1997 *Incorporating Intra-Aqueous Kinetics into Reactive Transport Models* presented at a Workshop on Modeling Reactive Transport held at Battelle PNNL, Nov. 28-Dec.2, 1997.

1996 Geological Society of America Symposium on *Application of Reactive Transport Modeling to Natural Systems*, October 28.

1996 Approaches to Modeling Reactive Transport, presented at the Mineralogical Society of America Short Course on *Reactive Transport in Porous Media*, October 25-27, Golden, Colorado.

1995 European Research Conference on *Natural Waters and Water Technologies*, November 3-8, Lenggries, Germany.

1995 Departmental colloquium, University of Idaho, March 10, Moscow, Idaho.

1994 Chapman Conference on *Hydrogeologic Processes: Building and Testing Atomistic to Basin-Scale Models*, June 6-9, 1994, Lincoln, New Hampshire.

1992 Departmental colloquium, Johns Hopkins University.

1990 V.M. Goldschmidt Conference, May, 1990

PROFESSIONAL ACTIVITIES:

Berkeley Lab Representative on panel to assess the state of flow and transport modeling at the Hanford Site, November 2005.

DOE representative on the Multi-Agency Panel on Reactive Transport Modeling, 2002 to present.

Environmental Science Program Technical Review Panel Member, May, 2002.

Shortcourse in Reactive Transport Modeling, University of Bern, Switzerland, April 8-10, 2002, Lead Instructor.

Yucca Mountain Unsaturated Zone/Radionuclide Transport Model Peer Review Panel, member, January-July, 1999.

Journal of Hydrology, Associate Editor (2002-2007)

American Journal of Science, Associate Editor (2002-2004)

Geofluids, Associate Editor

Reviews in Mineralogy Volume 34, Reactive Transport in Porous Media, Co-Editor

Member: American Geophysical Union, Geochemical Society

PUBLICATIONS:

Refereed Articles

Maher, K., C.I. Steefel, D. DePaolo, B. Viani, 2006, The mineral dissolution rate conundrum: Insights from reactive transport modeling of U isotopes and pore fluid chemistry in marine sediments. Geochimica et Cosmochimica Acta **70**: 337-363.

Steefel, C.I, D. DePaolo, and P.C. Lichtner, 2005, Reactive transport modeling: An essential tool and a new research approach for the Earth sciences, *Earth and Planetary Science Letters* **240**: 539-558.

Knauss KG, J.W. Johnson, and C.I. Steefel, 2005, Evaluation of the impact of CO_2, co-contaminant gas, aqueous fluid and reservoir rock interactions on the geologic sequestration of CO_2. *Chemical Geology* 217 (3-4): 339-350.

Davis, J.A., Yabusaki, S.B., Steefel, C.I., Zachara, J.M., Curtis, G.P., Redden, G.P., Criscenti, L.J., and Honeyman, B.D. 2004 Assessing conceptual models for subsurface reactive transport of inorganic contaminants. *EOS* **85(44)**, 449.

Pruess, K., Garcia, J., Kovscek, T., Oldenburg, C., Rutqvist, J., Steefel, C., Xu, T. (2004) Code intercomparison builds confidence in numerical simulation models for geologic disposal of CO_2. *Energy* **29**, 1431-1444.

Steefel, C.I. (2004), Evaluation of the field-scale cation exchange capacity of Hanford sediments. *Proceedings of the 11th International Symposium on Water-Rock Interaction,* R.B. Wanty and R.R. Seal (eds.), Taylor and Francis Group, London, 999-1002.

Lichtner, P.C., Yabusaki, S., Pruess, K., and Steefel, C.I. (2004) Role of competitive cation exchange on chromatographic displacement of cesium in the vadose zone beneath the Hanford S/SX tank farm. *Vadose Zone Journal* **3(1),** 203-219.

Steefel, C.I., Carroll, S., Zhao, P., and Roberts, S. (2003), Cesium migration in Hanford sediment: A multi-site cation exchange model based on laboratory transport experiments. *J. of Contaminant Hydrology* **67,** 219-246.

Glassley, W.E., Nitao, J.J., Grant, C.W., Johnson, J.W., Steefel, C.I., and Kercher, J.R. (2003) The impact of climate change on vadose zone pore waters and its implication for long-term monitoring. *Computers and Geosciences* **29**, 399-411.

Regnier, P., O'Kane, J.P., Steefel, C.I., and Vanderborght, J.P. (2002) Modeling complex multi-component reactive-transport systems: Towards a simulation environment based on the concept of a Knowledge Base. *Applied Mathematical Modeling* **26,** 913-927.

Pruess, K., Yabusaki, S., Steefel., C., and Lichtner, P. (2002). Fluid flow, heat transfer, and solute transport at nuclear waste storage tanks in the Hanford vadose zone. *Vadose Zone Journal* **1**, 68-88.

Giambalvo, E.R., Steefel, C.I., Fisher, A.T., Rosenberg, N.D., and Wheat, C.G. (2002) Effect of fluid-sediment reaction on hydrothermal fluxes of major elements, eastern flank of the Juan de Fuca Ridge. *Geochimica et. Cosmochimica Acta* **66**, 1739-1757.

Bildstein, O., Steefel, C.I., The Role of Pressure Solution in Fracture Healing: A Multi-Scale Reaction-Flow Modeling Approach. Proceedings of the 10th International Symposium on Water Rock Interaction, Villasimius, Italy, R. Cidu (ed.), Balkema, Lisse, The Netherlands, p. 141-144, 2001.

Yabusaki, S., Cantrell, K., Sass, B., and Steefel, C. (2001) Multicomponent reactive transport in an *in situ* zero-valent iron cell. *Environ. Sci. Technology* **35**, 1493-1503.

Steefel, C.I. (2000) New directions in hydrogeochemical transport modeling: Incorporating multiple kinetic and equiibrium reaction pathways. (L.R. Bentley, J.F. Sykes, C.A. Brebbia, W.G. Gray & G.F. Pinder, eds.) *Computational Methods in Water Resources XIII,* A.A. Balkema, Rotterdam, 331-338.

Regnier, P., and Steefel, C.I. (1999) A high resolution estimate of the inorganic nitrogen fluxes from the Scheldt estuary to the coastal North Sea during a nitrogen-limited algal bloom, spring 1995. *Geochim. Cosmochim. Acta* **63**, 1359-1374.

Steefel, C.I. and Van Cappellen, P.C. (1998) Reactive transport modeling of natural systems. *J. Hydrology* **209**, 1-7.

Steefel, C.I. and Lichtner, P.C. (1998) Multicomponent reactive transport in discrete fractures: I. Controls on reaction front geometry. *J. Hydrology* **209,** 186-199**.**

Steefel, C.I. and Lichtner, P.C. (1998) Multicomponent reactive transport in discrete fractures: II. Infiltration of hyperalkaline groundwater at Maqarin, Jordan, a natural analogue site. *J. Hydrology* **209,** 200-224.

Yabusaki, S.B., Steefel, C.I., Wood, B.D. (1998) Multidimensional, multicomponent subsurface reactive transport in nonuniform velocity fields: Code verification using an advective reactive streamtube approach. *J. Contaminant. Hydrology* **30**, 299-331.

Regnier, P., Wollast, R., and Steefel, C.I. (1997), Long-term fluxes of reactive species in macrotidal estuaries: Estimates from a fully transient, multicomponent reaction-transport model. *Marine Chemistry* **58**, 127-145.

Steefel, C.I. and MacQuarrie, K.T.B. (1996) Approaches to modeling reactive transport in porous media. In Reactive Transport in Porous Media (P.C. Lichtner, C.I. Steefel, and E.H. Oelkers, eds.), *Reviews in Mineral*ogy **34**, 83-125.

Regnier, P. and Steefel, C.I. (1996) Transient dynamics of reactive species in strong tidal estuaries. In Proceedings of the fourth international symposium on the geochemistry of the earth surface, July 22-28, 1996. (S. Bottrell, ed.), Leeds University Press, Leeds, 147-150.

Steefel, C.I., and Lasaga, A.C. (1994) A coupled model for transport of multiple chemical species and kinetic precipitation/dissolution reactions with application to reactive flow in single phase hydrothermal systems. *American Journal of Science* **294,** 529-592.

Steefel, C.I., and Lichtner, P.C. (1994) Diffusion and reaction in rock matrix bordering a hyperalkaline fluid-filled fracture. *Geochimica et Cosmochimica Acta* **58,** 3592-3612.

Steefel, C.I. and Lasaga, A.C. (1992) Putting transport into water-rock interaction models. *Geology*, **20**, 680-684.

Nagy, K.L., Steefel, C.I., Blum, A.E., and Lasaga, A.C. (1990) Dissolution and precipitation kinetics of kaolinite: initial results at 80C with application to porosity evolution in a sandstone. In *Prediction of Reservoir Quality through Chemical Modeling* (ed. I.D. Meshri and P.J. Ortoleva), *AAPG Memoir* **49,** AAPG, Tulsa, OK, 85-101

Steefel, C.I. and Van Cappellen, P. (1990) A new kinetic approach to modeling water-rock interaction: The role of nucleation, precursors, and Ostwald ripening. *Geochimica et Cosmochimica Acta*, **54,** 2657-2677.

Steefel, C.I. and Lasaga, A.C. (1990) The evolution of dissolution patterns: Permeability change due to coupled flow and reaction. In *Chemical Modeling of Aqueous Systems II* (eds. D. Melchior and R.L. Bassett), ACS Symposium Series No. 416, American Chemical Society, Washington, 212-225.

Steefel, C.I. (1987) The Johnson River Prospect, Alaska: Gold-rich sea-floor mineralization from the Jurassic. *Economic Geology*, **82**, 894-914.

Steefel, C.I. and Atkinson, W.W., Jr. (1984) Hydrothermal andalusite and corundum from the Elkhorn District, Montana. *Economic Geology*, **79**, 573-579.

Reports and Unrefereed Publications

Steefel, C.I. (2001) GIMRT, version 1.2: Software for modeling multicomponent, multidimensional reactive transport. User's Guide, UCRL-MA-143182. Livermore, California: Lawrence Livermore National Laboratory.

Steefel, C.I., and Yabusaki S.B. (1996) OS3D/GIMRT, Software for multicomponent-multidimensional reactive transport: User's Manual and Programmer's Guide, **PNL-11166**, Pacific Northwest National Laboratory, Richland, Washington.

Sevougian, S.D., Steefel, C.I, and Yabusaki, S.B. (1994) Enhancing the design of in-situ chemical barriers with multicomponent reactive transport modeling. In *In-Situ Remediation: Scientific Basis for Current and Future Technologies* (ed. G.W. Gee and N.R. Wing), 33rd Hanford Symposium on Health and the Environment,Battelle Press, Columbus, 883-911.

Steefel, C.I., Van Cappellen, P., Nagy, K.L., and Lasaga, A.C. (1990) Modeling water-rock interaction in the surficial environment: The role of precursors, nucleation, and Ostwald ripening. *Chemical Geology*, **84**, 322-325.